Astrobiology News April 2021: Yellowballs Revisited: New Insights into the Birth of Stars

Six years years ago during April 2015, I wrote an Astrobiology column for the Clergy Letter Project entitled, <u>Yellow "Space Balls" and the Origin of our Solar System</u>.¹ That column was about some very early research that my colleagues and I did on curious objects that were discovered and tagged as "yellowballs" by citizen scientists working on the <u>Milky Way Project</u>,² one of hundreds of research projects that have been launched on the online platform <u>Zooniverse</u>.³ In 2016, we updated the <u>Milky Way Project</u> interface to make identifying, and measuring the size of, yellowballs a top priority. By 2017, thousands of citizen scientists had "sized up" 6,176 yellowballs across the Milky Way.

Just this month, my colleagues and I published new results on these intriguing objects.⁴ While the paper in the Astrophysical Journal is a bit technical, several news outlets picked up on the press release that was issued by the Planetary Science Institute,⁵ and I've also written a blog⁶ about the research results for *Zooniverse*. In my April 2015 column, I noted that our early work suggested yellowballs are dusty "cocoons" enshrouding massive young stars before these stars visibly light up their birth clouds - like "prenatal" versions of the Orion Nebula star cluster. At a distance of some 1,300 light years from Earth, the Orion Nebula contains thousands of young stars, including stars that are more than 10 times as massive as our Sun and about ten thousand times brighter. These massive stars are really important because they explode after millions of years, enriching their surroundings with heavy elements that are important to life. We have several good reasons to think our Solar System formed near massive stars similar to those in the Orion Nebula.

It turns out that yellowballs are far more diverse than we originally thought. While we expect about 20% of them to evolve into clusters containing massive stars (the kind that explode after a few million years), about 80% of them won't. Yellowballs give us "snapshots" of prenatal star clusters across an extremely broad range of masses. This is significant because we now have a large database that we can use to compare conditions that give rise to massive stars to those that don't. Two of the most important things astronomers have learned about how stars form is that they typically form with planets and they form in close proximity to other stars. Planetary systems that have been discovered around other stars are very diverse. Most of them are very different from each other and from our Solar System. What accounts for this diversity? Learning more about the growth of star clusters will help answer this question, and we are deeply indebted to the thousands of citizen scientists who contributed their time and effort to make this research possible!

¹ <u>http://www.theclergyletterproject.org/pdf/abnews42015.pdf</u>

² <u>https://www.zooniverse.org/projects/povich/milky-way-project</u>

³ <u>https://www.zooniverse.org/</u>

⁴ Wolf-Chase, G. et al. 2021, The Astrophysical Journal, 911, 28 (17pp) (doi.org/10.3847/1538-4357/abe87a)

⁵ https://psi.edu/news/yellowballswolfchase

⁶ https://blog.zooniverse.org/2021/02/

Finally, for those of you who were unable to join us on April 6, I'm happy to say that Faith in Place⁷ has made our special environmental Zooniverse webinar with the <u>Chicago Muslims</u> <u>Green Team</u>⁸ available on YouTube: <u>https://www.youtube.com/watch?v=8PH-e13GVJQ</u> If you live in Illinois, check out all the great environmental resources at Faith in Place, or find your own state affiliate of <u>Interfaith Power & Light</u>,⁹ and take a look at their Justice, Equity, Diversity, and Inclusion (JEDI) Statement.¹⁰ As Michael is fond of saying, together we are making a difference!

Until next month,

Grace

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⁷ https://www.faithinplace.org/

⁸ https://chicagomuslimsgreenteam.org/

⁹ https://www.interfaithpowerandlight.org/about/state/

¹⁰ https://www.interfaithpowerandlight.org/about/ipls-jedi-statement/